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Hydraulics

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Water Resources

Original

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MAR 12 2012

DEPARTMENT OF
WATER RESOURCES

March 9, 2012

Mr. Gary Spackman, Director
Idaho Department of Water Resources
322 East Front Street
P.O. Box 83720
Boise, ID 83720

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MAY 03 2012

DEPT. OF WATER RESOURCES
SOUTHERN REGION

Re: Application for Permit 37-22685 Ground water heat pump and injection

Dear Gary:

Brockway Engineering recently submitted an application for permit for Harry and Shirley Hagey for a ground water heat pump system for their new residence in Blaine County. The application along with an application for a shallow injection well permit was sent to Matt Anders at IDWR in Boise. The shallow injection well application was approved and the application for the ground water heat pump system was ultimately referred by Shelley Keen to Michele Edl for her review. She prepared a memo with her review of the application and sent the memo to Allen Merritt at the Southern Region (memo attached). A memo from the Southern Region indicates the permit application No 37-22685 will be advertised on 3/07/2012.

The purpose of this letter is to take issue with many of the remarks and requirements which Ms. Edl included in her memo as it relates to requirements for applications for permits for these types of water uses.

- The application for a water right permit is based on estimates of water requirements and planned system equipment and is seldom based on as-built or design data which are required for licensing.
- Ms. Edl in her memo indicated that she has "reviewed several heating and cooling water right files in the past few months and I have found that they have common problems that must be overcome before a license can be issued (emphasis added)." This application is for a permit and is not a beneficial use licensing exam. The specificity of information necessary to be supplied for the application for a permit should be sufficient to allow a determination of a reasonable discharge allowance so that development, including final design, can occur.

CHARLES E.
BROCKWAY,
PH.D., P.E.

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- Under her heading Common Problems with Heating/Cooling Rights, she states that “A volume is required at licensing, so it must be estimated from available information.” I agree that a volume is required at licensing. This application is for a permit. Ordinarily, no annual volume amount is listed on a permit, as that figure is determined during licensing.
- Ms. Edl opines that “Heating/cooling volumes recommended by field examiners are typically flawed in two ways-----”. To mitigate for these common flaws, it is important to begin the water rights process with a rate that is representative of the actual space heating/cooling requirements. At the time a permit is issued, this rate should be known.” I am not sure whether Ms. Edl is confusing volumes with rates, but I object to the generalized opinion that these recommended volumes or rates are typically flawed. Is her experience vast enough to justify an opinion and a reflection on field examiners that their recommendations are typically flawed? At the time of application for a permit, generally, specific equipment has not been designed and actual water requirements cannot be known, but they can be estimated. The Hagey application is based on estimates from two heating and cooling contractors based on potential equipment water requirements.
- Ms. Edl believes, apparently, that applicant’s statements of water requirements are not representative of actual use and that, “If we can get satisfactory information from the applicant at the onset of the water rights process, we will likely approve a more representative, and often lower, diversion rate (emphasis added).” If estimates of water requirements are based on potential equipment specifications and/or recognized guidelines for estimating water requirements, then that should suffice for permit applications.
- Ms. Edl states that the Hagey application is unsatisfactory in two areas:
 1. It lacks sufficient information to justify the proposed rate
 2. The proposed uses either are or have the likelihood of being consumptive.The first statement is addressed above. The second statement is

speculative at best. The likelihood of being consumptive is based on an assumption that the re-injection facility design is flawed and will likely fail. Ms. Edl continues by comparing the Hagey application to water right 21-7567 licensed in 2012 for Fall River Rural Electric Cooperative Inc. for multiple heat pumps for a commercial warehouse. The permit for this right was issued for 0.22 cfs (98.7 gpm) in 1997 for a 33,400 sq ft warehouse and office for 28 people. The field examiner for the water right (Paul Meyer) recommended 0.22 cfs for heating and cooling and domestic use based on a field exam conducted on August 18, 1999. Ms. Edl prepared a license review memo for this water right on January 17, 2012 and the right was licensed on January 18, 2012 for 0.19 cfs. The permit for construction of an 8 inch diameter injection well for the closed loop heat pump effluent for Fall River Rural Electric Cooperative Inc. was approved in 2006 by IDWR for a maximum discharge of 100 gpm (.22 cfs) with a depth of 83 feet. The field examiner noted in his exam report that the injection well for 21-7657 “---had problems at time of exam, could not take effluent and was overflowing. This is a common problem, so system of ponds built to hold overflow from system ponds are fed through pipes from pitless adapter and creek/culverts”. The examiner further stated that there were 3, 16 gpm and 1, 2 gpm heat pumps over the warehouse as well as 3, 6 gpm; 2, 8gpm and 1, 2 gpm heat pumps over the office. At the time of the licensing exam it appears that the 33,400 sq ft complex was supplied by 11 heat pumps including the one being licensed. There are no other water rights on the IDWR data base for heating and cooling for Fall River Rural Electric.

- To imply or assume that all injection wells are prone to failure and that, because the field examiner found for water right 21-7657 that the injection well capacity was inadequate, the Hagey engineered shallow injection well will result in a failure and further that “this type of failure will expose ground water to surface conditions and consumptive use” is completely invalid. This statement appears to question the engineer’s design capability and could result in denial of the permit.

- Ms. Edl states that “In the narrative for application question 9, the applicant proposes uses which are, at least in part, consumptive”. Question 9 specifically asks if there are any other water rights used for the same purpose as the current application. Since the same production well will be used for the domestic household use the application includes the request for irrigation up to 0.5 acres or 13,000 gallons per day for domestic use as per I.C 42-111a which allows consumptive use. Since there are no other water rights used for heating or cooling and the domestic use does not exceed exempted volumes or uses, I fail to see where this application proposes uses which are consumptive. Ms. Edl appears to be utilizing criteria for licensing as criteria for evaluating a permit application which is unjustified and not consistent with prior processing of permits by IDWR.
- Ms. Edl’s recommendations for the Hagey application indicates that “For a heat pump system to be properly presented to the homeowner, one or more of the following should have been provided
Load calculations showing the BTU requirement (room by room or whole house)
Manufacturer’s spec sheets showing the heat pumps BTU output at different outside temperatures
Heat pump balance chart that shows the heat pump will produce enough head down to a given temperature”. This statement seems to suggest that the potential system specific design parameters and equipment should have been supplied to the homeowner. I submit that this is an effort to dictate or at least interfere with a consultant/client relationship which is of no concern to the Department.
- I would request that you review the approved applications for permits for ground water heat pumps submitted for two of our clients:
1. Permit 37-22576 for Jim Luckman, Hailey, Idaho approved December 7, 2010,
Single family residence (8,200 sq ft heated), one level, production well and injection well(s), Approved discharge 0.16 cfs (72 gpm)
Comment report by IDWR-not in backfile

2. Permit 37-22334 for Tracy Flaherty, Hailey, Idaho approved September 9, 2008, Single family residence, one level, production well and injection well, Approved discharge 0.25 cfs (112 gpm) Comment report by IDWR-1.1 pages.

These two applications are for heating and cooling uses for single family residences, in the same climatic region, the same types of equipment, and nearly the same size houses. If IDWR reviews are consistent, why does Ms. Edl infer that discharge requested for the Hagey application is too high when it is less than the discharge approved for permits for either of the two other residences in the same area?

The memo by Ms. Edl and a subsequent request by Allen Merritt asked for additional information. The following provides that information and data as provided by the designers at this time. The initial design parameters supplied by the contractors on which the application for permit was prepared indicated a discharge of 71.8 gpm would be required. This preliminary design data and equipment has already changed from the initial estimates and may change again before final design and construction as is usually the case. That is why information normally supplied with a permit application is preliminary and estimated and not design level or operational data.

- The heating/cooling system for the new Hagey, 8,000 square foot, single story residence was designed by two different contractors. The primary system, specified by Sawtooth Plumbing of Ketchum is a water to water-hydrionic radiant floor heating system with heat pump. The initial design discharge was estimated at the contractor's design criteria for the Big Wood River area at 3.2 gpm/Ton with a computed heat load of 12 ton (144,000 BTU/hr.). The secondary system was specified by Thornton Heating and Sheetmetal, also from the Big Wood River area, and is a forced air, water- to- air heat pump with an estimated discharge requirement of 3.2 gpm/ton. The combined load, based on the primary and secondary system operating simultaneously is estimated to require a 22.4 ton system. This resulted in an initial estimated design flow rate of 71.8 gpm (0.16 cfs).
- The use is non-consumptive. There is no component of the proposed use that is consumptive. It is a closed system within the residence and the effluent injection is into the same aquifer as the production well.

The effluent injection sump serves to convey the requested 71.8 gpm maximum flow into the shallow aquifer and the sump also serves as the source for water for fire protection, as approved by the Wood River Fire District. I am enclosing a drawing of the proposed heating system disposal and fire protection sump.

- The hydraulic capacity of the re-injection system utilizing the proposed, perforated, 4.0 ft diameter CMP is more than adequate for the 71.8 gpm maximum effluent discharge. The depth to water at the sump has been measured at 5.2 ft below ground level. The estimated seepage area including the 4.0 ft diameter bottom of the CMP plus the clean cobble is approximately 1009 sq feet. The Theiss equation for a partially penetrating well (Bradbury and Rothschild (1985) specific capacity method and Sternburg (1973) partial penetration approach) in very permeable gravel (300 ft/day) shows that, with a conservative surcharge of 2 ft of head on the ground water level, the calculated capacity of the system is 0.22 cfs or 100 gpm. The water level in the CMP could operate at higher than a 2.0 ft surcharge which will increase the calculated infiltration capacity which is nearly linearly with the surcharge level.
- The winter time shallow aquifer water temperature and design temperature was estimated at 50°F based on measured adjacent stream temperature in the Black's Slough stream. Based on the 50°F temperature and a new, preliminary equipment selection, the primary heating system with radiant in-floor piping will require heat pumps with about 10 ton capacity at 2.8gpm/ton or about 28 gpm. The preliminary equipment selection is a GeoComfort GWT 120 unit with dual stage, dual compressor, and 10 ton capacity. The secondary system is 3 Bosch Aquarius II Series heating units selected by Thornton (models AP061, AP049, AP035); the required flow for the secondary heating system is 3.2 gpm per ton to keep the water from 'slushing'. The Bosch equipment would require 12 tons at 3.2 gpm/ton or 38.4 gpm maximum for the secondary heating system. The total estimated required discharge is 28+38.4 gpm or 68.4 gpm (0.152 cfs). These estimates may change for the final design.

- I do not know the net R value for the insulation for the Hagey residence. It is an upscale home and has a high R value. This would certainly classify the home as 'best energy efficiency' according to Administrator's Memorandum for Application Processing No. 23 (Amended).

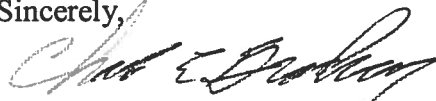
Summary:

1. The application submitted for the Hagey residence is for a permit to appropriate water not a beneficial use field exam for licensing purposes.
2. Generalization regarding the inadequacy of heating/cooling recommendations by field examiners and the assertion that these values are 'flawed' is not warranted. Implying that the level or specificity of information required for a permit application is the same as for a licensing exam is incorrect.
3. Implying that applicant's estimated discharge requirements are inflated and that 'If we can get satisfactory information from the applicant at the onset of the water rights process, we will likely approve a more representative, and often lower, diversion rate' infers that the Department's goal is to lower the approved diversion rate during licensing rather than confirm or affirm an actual required rate within the permitted amount.
4. Speculation by Ms. Edl that, because one other facility encountered a problem with an injection well, that the Hagey system will be suspect and ought to require significantly more design data than is normally supplied with a permit application is not warranted.
5. Required information for processing a heating/cooling application for permit should be adequately estimated by the applicant so that IDWR can reasonably estimate the operating requirements and should not require design specifications. The period for construction and development should allow adequate time for fine tuning and development of operational criteria upon which to base a license.

Permit 37-22685 Ground water Heat Pump and Injection

Ms. Edl has had significant difficulties with applications and beneficial use exam reports provided by Brockway Engineering. Specifically, our clients have been particularly annoyed with the time requirements for us to provide superfluous or unneeded information for permit applications and/or beneficial use exams. Even when the information record is complete, the processing time has been excessive. We have clearly provided more information than statutorily required for permit applications pursuant to I.C. 42-202(1) and (4).

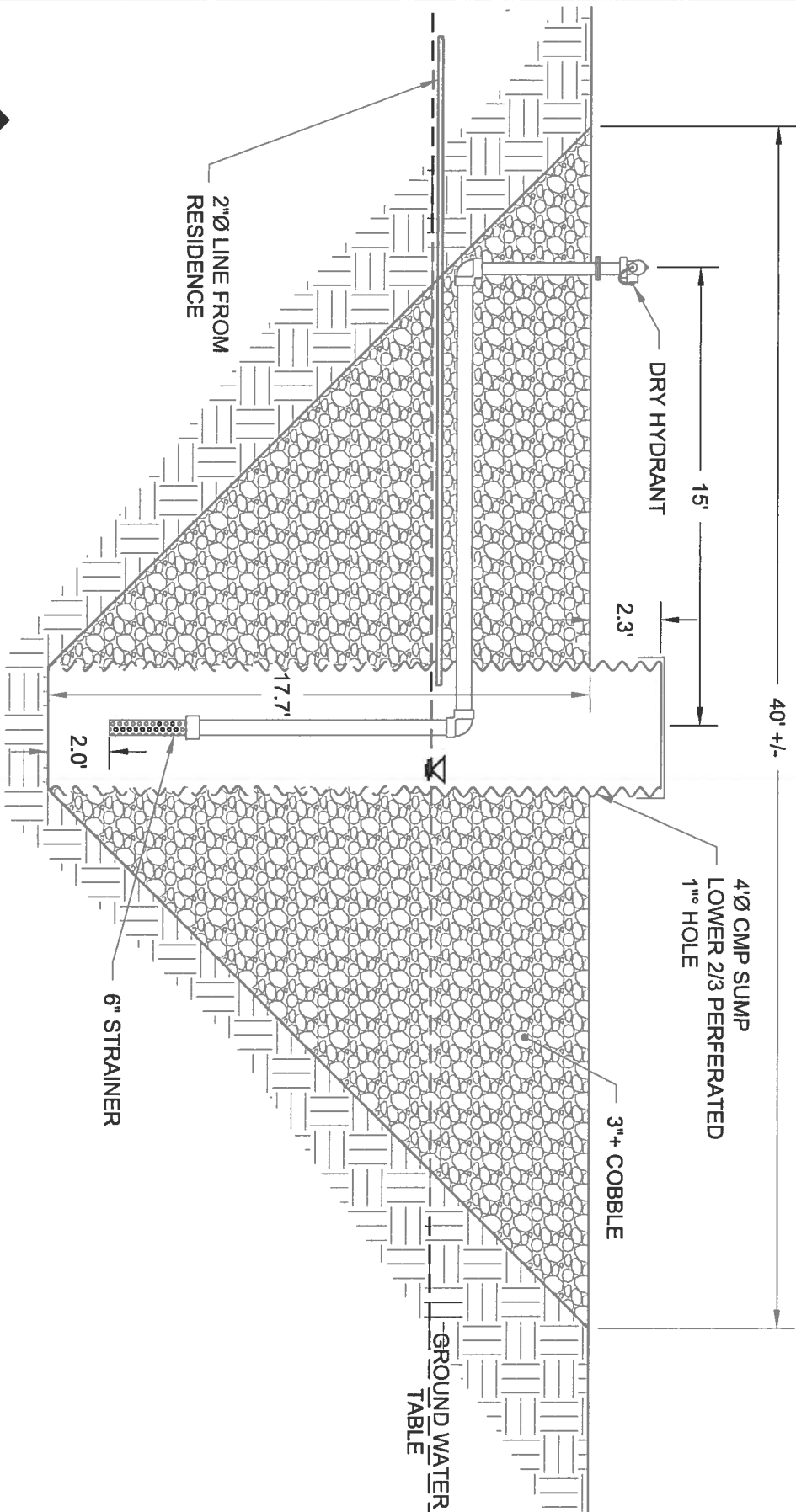
Sincerely,

A handwritten signature in black ink, appearing to read "Charles E. Brockway", written over a light blue horizontal line.

Charles E. Brockway, P.E.

Cc: Allen Merritt, IDWR Southern Region
Shelley Keen

Encl: Memo: Michele Edl to Allen Merritt February 23, 2012
Shallow Injection Well Schematic – Hagey Residence
Well capacity evaluation – Hagey Injection Well



HAGEY RESIDENCE - SHALLOW INJECTION WELL

SCALE: 1"=5'

THIS DRAWING HAS BEEN PREPARED BY
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REV	DESCRIPTION	DATE	APPRO. BY
A	ISSUE FOR REVIEW	2/7/12	

DESIGNED BY	DRAFTED BY
	ALR

BROCKWAY ENGINEERING, PLLC
HYDRAULICS - HYDROLOGIC - WATER RESOURCES
2016 NORTH WASHINGTON, SUITE 4
TWIN FALLS, ID 83301
(208) 738-8543

HAGEY RESIDENCE
SHALLOW INJECTION WELL

PROJECT #	DWG#	REV
787-07-2011	1	A

Transmissivity Estimation with Partial Penetration

Bradbury and Rothschild (1985) specific capacity method.

Suitable for situations where a single time and drawdown measurement is available.

Includes effects of partial penetration using Sternberg (1973) approach.

Enter data in blue, pay attention to units.

Well pumping rate	100 [gpm]	19251.34 ft ³ /d
Drawdown	2 [ft]	
Time	43200 [minutes]	30 days
Well radius	24 [inches]	2 feet
Storativity	0.15 [unitless]	
Aquifer thickness	95 [ft]	
Open interval	12.5 [ft]	

Calculations:

Specific capacity	50 [gpm/ft]
L/b	0.131579
G	2.166717
sp	11.18049

Trial T	28606.0 [ft ² /d]	<--- Vary Trial T until about equal to Calc T
Calc T	28606.0 [ft ² /d]	
Calc K	301.1 [ft/d]	

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FEB 28 2012

MEMORANDUM

DEPT. OF WATER RESOURCES
SOUTHERN REGION

Date: February 23, 2012
To: Allen Merritt
From: Michele Edl
Re: Hagey application review

Background

This application was submitted to the state office UIC group. I have reviewed several heating and cooling water right files in the past few months and have found that they have common problems that must be overcome before a license can be issued. Before forwarding this application to Southern Region for action, Shelley Keen asked me to review it and write a memo documenting any concerns I might have. We hope that the insight I have gained about this type of permit can be used both to alert you to the problems they pose and to expedite your processing.

Common Problems with Heating/Cooling Water Rights

As a non-consumptive use, records of the volume of water used for heating/cooling are not required by permit conditions. Nor are they requested from the permit holder at the time that they submit their proof statement. A volume is required at licensing, so it must be estimated from available information.

Heating /cooling volumes recommended by field examiners are typically flawed in two ways: the diversion rate authorized by the permit is used to determine a volume without reference to the heat transfer capability of the system or the volume is based on continuous pumping rate over a period rather than continuous heat exchange over a period. To mitigate for these common flaws, it is important to begin the water rights process with a rate that is representative of the actual space heating/cooling requirements. At the time a permit is issued, this rate should be known.

Space heating and cooling environments are constructed, controlled environments. The heating and cooling loads for maintaining the comfort of those spaces will be estimated before purchasing equipment to meet those needs. If water is the heat transfer medium, then the water demand of the heat exchange appliances should also have been estimated. If they have not been, then the permit holders may be entering the water rights process prematurely. The rate authorized by a permit for heating/cooling should be based on heat transfer water rates of the HVAC equipment not on the well or pump capacity.

If we can get satisfactory information from the applicant at the onset of the water rights process, we will likely approve a more representative and often lower, diversion rate. If we approve a lower diversion rate, we can get closer to a reasonable estimate for a volume even if that estimate is based on an unlikely continuous use calculation.

If we can't rely on a heat transfer-based, water rate to put an upper boundary on the volume estimate, then we'll need to issue the permit with measuring and reporting conditions.

Specific Problems with Hagey Application

This application proposes use of ground water diverted from within the Big Wood River Ground Water Management Area. Brockway Engineering, PLLC staff completed the application on behalf of the Hageys. The proposed uses are heating and cooling and domestic.

Although this application appears complete, (i.e. the blanks have been filled in), I find that it is unsatisfactory in two areas:

- 1) It lacks sufficient information to justify the proposed rate
- 2) The proposed uses either are or have the likelihood of being consumptive

Assessment

Reference to a concrete example of recent state office license activity should provide you the basis for a quick comparison.

IDWR recently issued a license for a water right in Ashton, Idaho. I reviewed the file and compiled supporting documents. Right 21-7567 was issued for a heating/cooling system very similar to the one described by this application: an open loop, heat pump system, accessing ground water from single well and re-injecting the system discharge into another existing well.

Item 1)

The rate of water used by that multiple, heat pump system was 0.19 cfs and is more than the rate requested by the Hagey application. However, that system served the heating/cooling requirement of a 33,400 square foot office and warehouse complex.

The rate 0.16 cfs, requested for heating/cooling use in this Hagey application appears excessive. Single family homes using heat pumps for heating/cooling typically require water flow rates an order of magnitude less than this application proposes.

An injection well failure is not uncommon. The heating/cooling discharge can soon reach the capacity and be rejected by the injection well. The examiner for right 21-7567 found and described ponds which had developed on the property from overflow of the injection well. In that case neither the system operator nor I were able to locate well logs for the injection well. Lack of knowledge about the construction or the capability of that irrigation well may have contributed to the misapplication and malfunction as an injection well.

Item 2)

This type of failure will expose ground water to surface conditions and consumptive use. Without a demonstrated understanding of the sumps capacity to accept discharge expected from the heating/cooling system, the applicants run the real risk of installing a system that puts them out of compliance with constraints of the ground water management area.

In the narrative for application question 9, the applicant proposes uses which are, at least in part, consumptive.

Recommendations

Item 1)

Administrators Memorandum 23 Rate of Flow for Heating Use is still IDWR standard procedure for processing a heating/cooling proposal at the application level. The Hagey application does not provide the information required to satisfy that memo.

For a heat pump system to be properly presented to the homeowner, one or more of the following should have been provided,

- Load calculations showing the BTU requirement (room by room or whole house)
- Manufacturers spec sheets showing the heat pumps BTU output at different outside temperatures
- Heat pump balance chart that shows the heat pump will produce enough heat down to a given temperature.

If specific, heat pump information is not available, IDWR staff will need to request the design parameters required to complete the skeleton heating design which is outlined in Administrator Memorandum 23. Specifically, that means requesting the following information:

- The dimensions or square footage of the building(s)
- The number of stories of the building(s)
- The temperature of the water you expect to use

- The insulation value or the R value of the building

Although IDWR cannot require that a building be designed efficiently, we can require that water be used efficiently. A heat pump system properly matched to the square footage of a building is energy efficient and demonstrates a sort of "due diligence".

Item 2)

Heat pumps cannot supply all the heat required by building at outside temperatures below the balance point. A heat pump system in the Hailey/Ketchum climatic region will likely require a supplemental heat source. The applicant should expect to use a supplemental heat system as the primary heat system if/when the injection sump reaches its capacity to accept heating system discharge and becomes a consumptive surface water feature.

Although more expensive to install, a closed loop heat pump system which eliminates the injection well/sump and the companion potential for consumption use of ground water could be developed instead.

In conclusion

I do not find this application has supplied sufficient information.

If this application is permitted, it should include conditioning which puts the permit holder on notice of the consequences for regression to a non-consumptive use.

If IDWR is provided an acceptable description of a system's water use and heat transfer rate, we will not need to issue this heating/cooling permit with a condition that requires the permit holder to keep volume records and provide them when they submit proof.